NOvA Quality Control

Sarah Budd

Argonne National Lab

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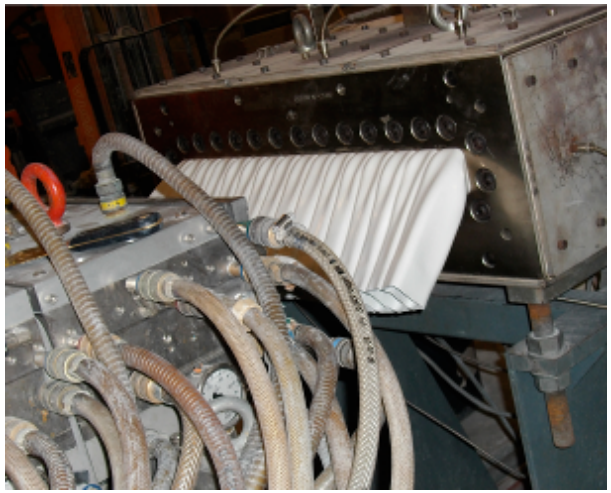
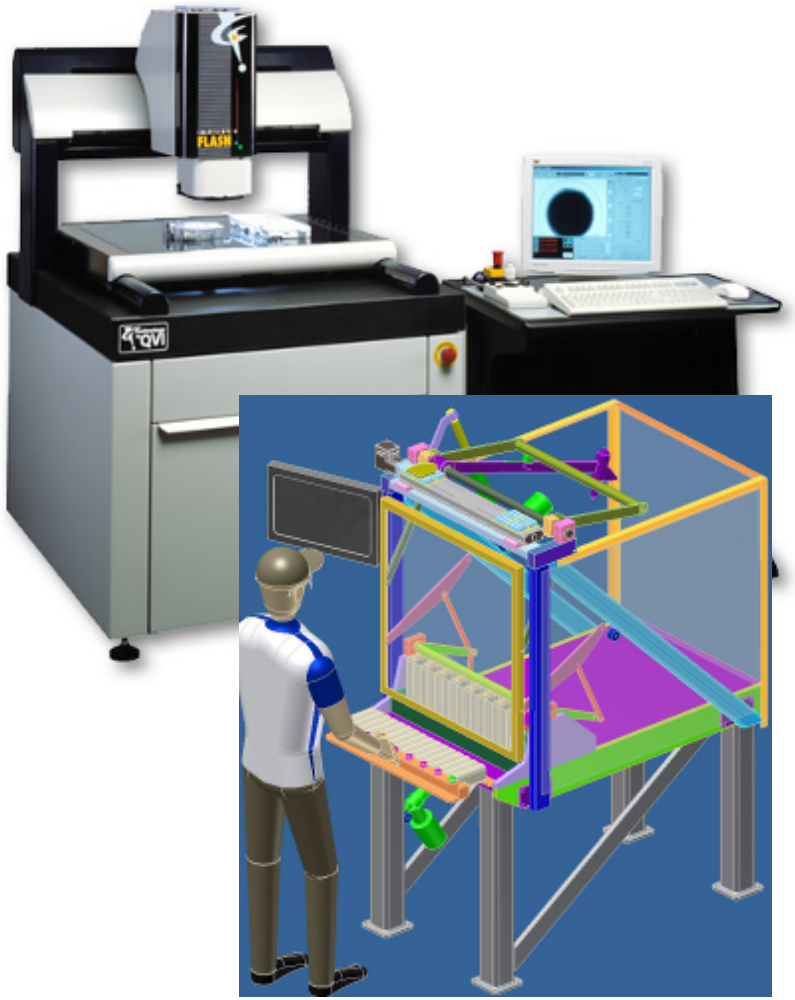
NOvA hardware tasks at ANL

- Argonne is in charge of two large components of the NOvA near detector construction
  - PVC extrusions
  - Block Assembly
- PVC extrusions for the near detector have been made
  - We are gearing up to make far detector extrusions
  - New QC procedures are being implemented
    - Including my main PVC project: simulated photon yield
- Module assembly is underway
  - We have finished 4 blocks, and are building a fifth block as we speak
  - I'm in charge of QC for the near detector modules before they are assembled into blocks



PVC Quality Control Upgrades

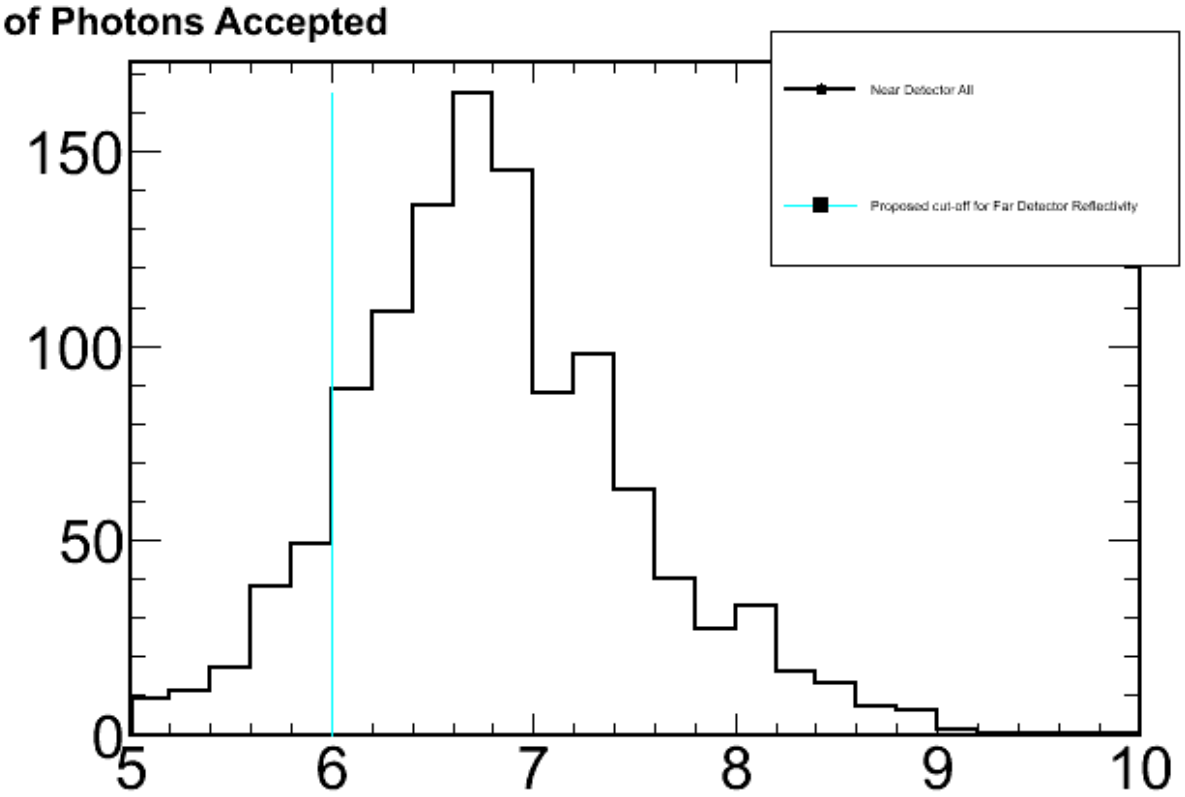
- Purchased a turn-key vision inspection system to make dimensional measurements
- Developing several new QC tests
  - Automated pendulum impact tester
  - Vacuum Integrity Tester
  - Pressure Tester
  - ‘Bananometer’
  - **Simulation of light yield output**



Relative Light Yield Simulation

- Program simulates the light yield in NOvA near detector extrusions
- Input is a file consisting of reflectivity measurements
  - For wavelengths from 340nm to 470nm
- Output is a file containing the percentage of photons that reach the readout end of the extrusion
- We have a proposed quality control cut based on the percentage of simulated photons reaching the readout end

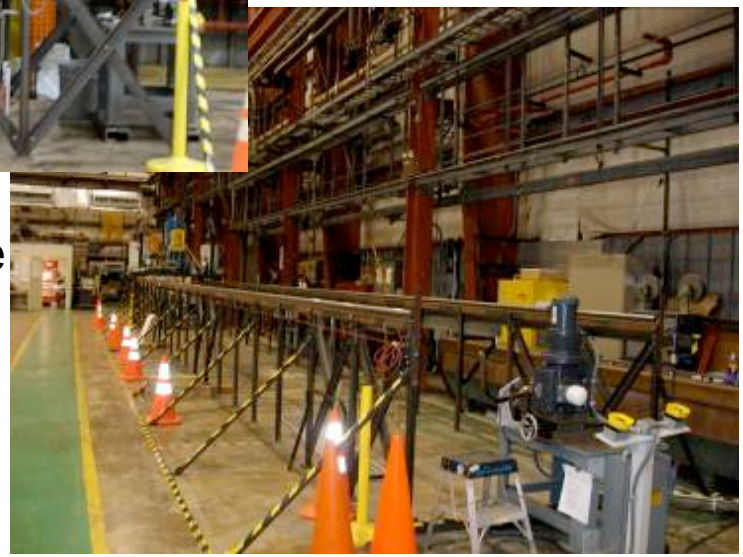
Light Yield of Near Detector Modules with QC Cut



- Light yield for all measured PVC extrusions (black) and proposed light-yield cut for the far detector (teal)
- We are finishing measuring the reflectivity for remaining near detector extrusions

Block Construction at Argonne

Near Detector lifting fixture



Glue machine

Compression fixture

Prototype Block and First Near Detector Block

The first mechanical prototype block (protoblock)

- Constructed at Argonne
- Raised in the MINOS service building

First block being shipped to Fermilab

- Four blocks are finished, fifth block is being built
- Plan to be finished by mid-summer

Module Quality Control for Block Construction

- Quality Control checks are done at Argonne to check for any defects in the modules that may have occurred during the shipping process or otherwise
  - Visual Checks
  - Optical Checks
  - Leak Checks

Checking for Leaks

Optical Fiber Face

Too much glue

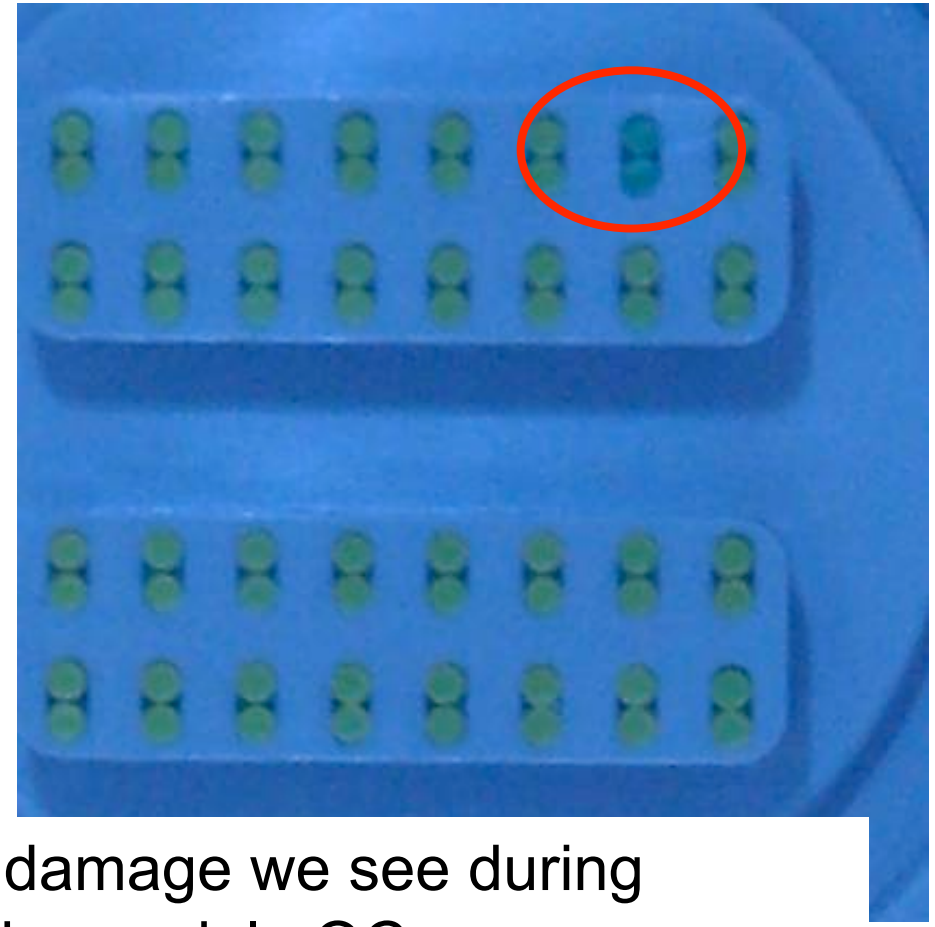
Leak Checking

- We test for leaks a bubbler system developed at the University of Minnesota
  - Test at low pressures (4pis)
  - We can see leaks at this level (~10 micron)
  - We also are setup to test while modules are on a stack
- Bubbler setup has some drawbacks
  - With our setup, the bubbler itself sometimes leaks, creating a high false positive rate
  - Zelimir Djurcic is working on a leak test system that is simpler to operate, can be done more efficiently
    - For use on the far detector

Fiber damage example

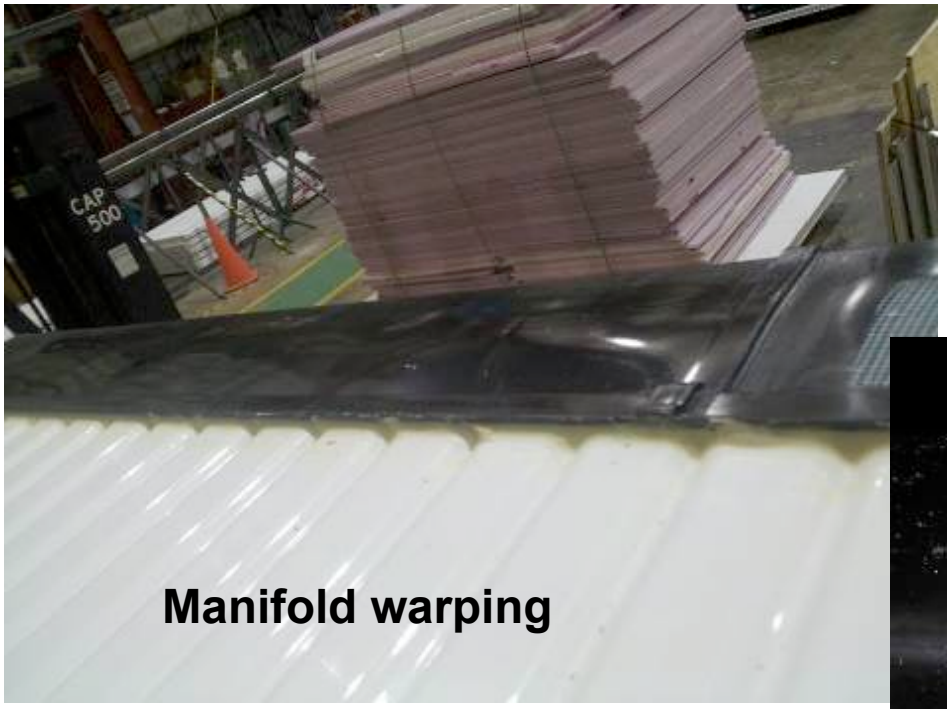
At MN

At ANL

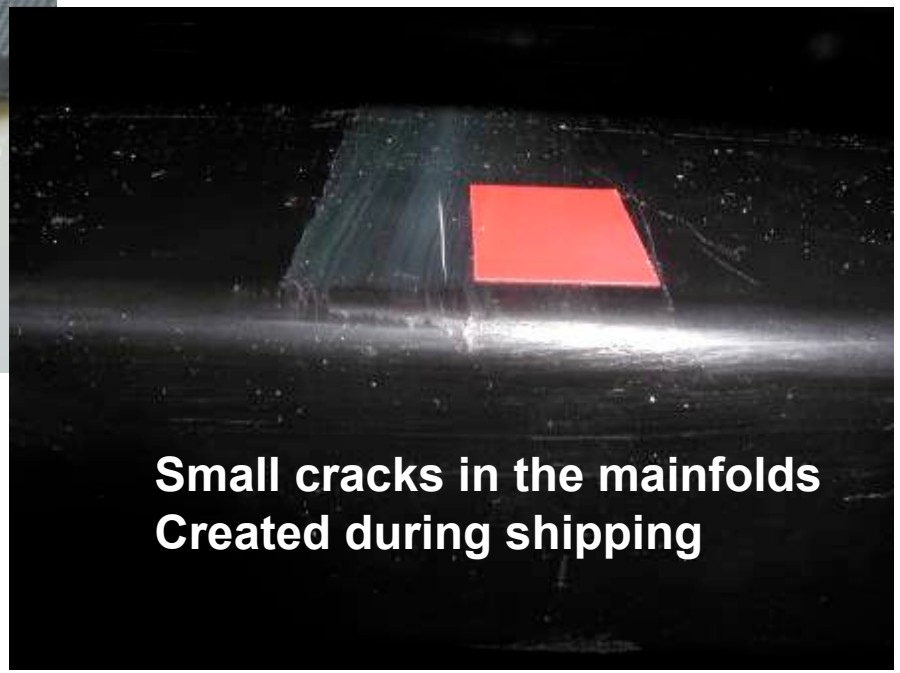


This is typical of the fiber damage we see during shipping, and catch with the module QC.

Other types of damage



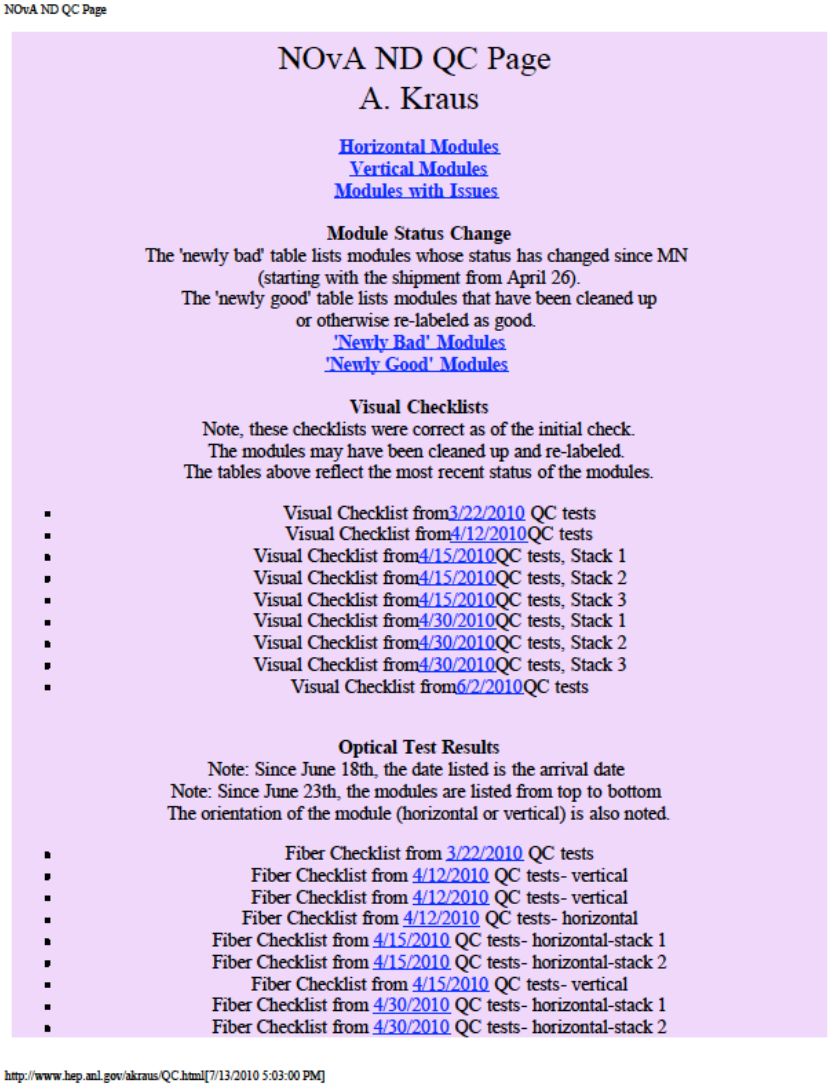
Manifold warping



Small cracks in the mainfolds
Created during shipping

Summer ACTS/TARA Teacher

- Amber Kraus is helping with NOvA module QC as part of her summer project
  - Helping with visual, fiber and leak tests
  - Taken charge of the module QC tables and web-pages
  - Will quantitatively analyze results of near detector PVC and module QC tests



NOvA ND QC Page

NOvA ND QC Page
A. Kraus

Horizontal Modules
Vertical Modules
Modules with Issues

Module Status Change
The 'newly bad' table lists modules whose status has changed since MN (starting with the shipment from April 26).
The 'newly good' table lists modules that have been cleaned up or otherwise re-labeled as good.
'Newly Bad' Modules
'Newly Good' Modules

Visual Checklists
Note, these checklists were correct as of the initial check.
The modules may have been cleaned up and re-labeled.
The tables above reflect the most recent status of the modules.

- Visual Checklist from3/22/2010 QC tests
- Visual Checklist from4/12/2010QC tests
- Visual Checklist from4/15/2010QC tests, Stack 1
- Visual Checklist from4/15/2010QC tests, Stack 2
- Visual Checklist from4/15/2010QC tests, Stack 3
- Visual Checklist from4/30/2010QC tests, Stack 1
- Visual Checklist from4/30/2010QC tests, Stack 2
- Visual Checklist from4/30/2010QC tests, Stack 3
- Visual Checklist from6/2/2010QC tests

Optical Test Results
Note: Since June 18th, the date listed is the arrival date
Note: Since June 23th, the modules are listed from top to bottom
The orientation of the module (horizontal or vertical) is also noted.

- Fiber Checklist from 3/22/2010 QC tests
- Fiber Checklist from 4/12/2010 QC tests- vertical
- Fiber Checklist from 4/12/2010 QC tests- vertical
- Fiber Checklist from 4/12/2010 QC tests- horizontal
- Fiber Checklist from 4/15/2010 QC tests- horizontal-stack 1
- Fiber Checklist from 4/15/2010 QC tests- horizontal-stack 2
- Fiber Checklist from 4/15/2010 QC tests- vertical
- Fiber Checklist from 4/30/2010 QC tests- horizontal-stack 1
- Fiber Checklist from 4/30/2010 QC tests- horizontal-stack 2

http://www.hep.anl.gov/akraus/QC.html[7/13/2010 5:03:00 PM]

Conclusions

- Argonne is in charge of NOvA PVC production and near detector block assembly
- QC for the PVC production is being upgraded for the far detector
  - Upgrades, including a simulated light-yield cut, are nearly finished
- QC for modules prior to block assembly for near detector is ongoing
  - Includes leak, fiber and visual checks
- I am also working on several other NOvA and MINOS projects
  - MINOS calibration group, MINOS nue appearance analysis, MINOS beam monitoring
  - NOvA event generation